



A simple mechanism for rotation reversal in ohmic L modes

Naulin, Volker; Xu, G.

Publication date:
2012

[Link back to DTU Orbit](#)

Citation (APA):

Naulin, V., & Xu, G. (2012). *A simple mechanism for rotation reversal in ohmic L modes*. Abstract from 17th Joint EU-US Transport Task Force Meeting and 4th EFDA Transport Topical Group Meeting, Padova, Italy.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

A simple mechanism for rotation reversal in ohmic L modes

V. Naulin¹, G. Xu², J. Juul Rasmussen¹, N. Yan^{1,2,3}

1. *Association EURATOM – DTU Physics, Section Plasma Physics and Fusion Energy, Rsiø Campus, Frederiksborgvej 399, DK 4000 Roskilde, Denmark*
2. *Institute of Plasma Physics, Chinese Academy of Sciences, Hefei 230031, People's Republic of China*
3. *Sino – Danish Center for Education and Research, Niels Jensens Vej 2 - DK-8000 Aarhus C - Denmark*

TOPIC: C) Momentum and particle/impurity transport, and impact of rotation on transport

Rotation of L-mode plasmas is a complex issue, with many different effects having been observed. In general the L-mode rotation behaviour, unless there is a strong external source of momentum, is far less well understood than the rotation of H-mode discharges. H-mode rotation seems to be more robust, either because the H-mode is usually achieved at high heating power including external momentum input by beams or due to high rotation at the pedestal, which allows for a robust boundary condition for the rotation.

For plasmas with no obvious external momentum source spontaneous spin up poses a problem to transport theory as without initial rotation velocity or seed flow the momentum flux is zero everywhere and so no build-up of rotation, neither of net plasma rotation or of differential plasma rotation can take place.

While the most prominent source of plasma toroidal momentum is the tangential injection of neutral beams, there are several effects which allow for momentum input from the edge. None of these mechanism can so far explain the observed rapid transition from co to counter-rotation observed in Alcator C Mod and other devices when the edge density is increased in ohmic L-mode plasmas.

It has been suggested that turbulent momentum transport can lead to differential transport of positive and negative momentum fluctuations, thus leading to a differential rotation source, which can lead to spin up. This local momentum flux, which is generated in the plasma itself, cannot be expressed in terms of a transport term as it is neither proportional to the gradient of the velocity profile, e.g. to be expressed as a diffusion like term, nor to the velocity itself, e.g. a convective or pinch velocity like term. Its appearance in a transport equation is like a localised source.

Several experiments have tried to measure this effect, but it is notoriously difficult to separate from other sources of momentum and moreover only during spin up and spin down of the plasma it leads to measurable momentum fluxes out of the plasma. This Residual Stress exerts a zero net torque on the plasma but can create nonzero momentum fluxes. It is usually not captured by transport models. We here demonstrate in a simple transport model how RS can lead to rotation reversal.

Corresponding author: Volker Naulin

Name: Volker Naulin

Email: vona@fysik.dtu.dk